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## **PROGRAM CHARTER FOR**

### **CLIMATE FORCING**

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#### **1. EXECUTIVE SUMMARY**

The objective of the Climate Forcing Program is to better quantify the information on atmospheric composition and feedbacks that contribute to changes in Earth's Climate. Specifically, the Program seeks to provide the understanding needed to link "emissions" to the "radiative forcing of climate change" for science-based decision support. Our goal is "a predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions."

The Climate Forcing Program is providing research (i) to understand atmospheric and oceanic processes, both natural and human-related, that affect carbon dioxide trends, (ii) to quantify the climate roles of the radiatively important trace atmospheric species such as fine-particle (aerosols), ozone, and chemically active greenhouse gases, and (iii) to understand and assess stratospheric ozone depletion. Research area (i) may be directly applied to climate projection and to policy decisions regarding carbon management that are related to limiting unwanted effects of future climate change, while research area (ii) provides timely and adequate information needed to broaden the suite of non-carbon options for addressing changes in climate forcing.

Climate Forcing activities occur around the globe, through extensive observing networks maintained by NOAA, through field campaigns led by or involving NOAA, and through studies in the NOAA laboratories. Work on this program is conducted through the Oceanic and Atmospheric Research and National Environmental Satellite, Data and Information Services Line Offices at NOAA, and the National Weather Services (NWS). Research and programmatic activities are primarily organized or carried out in Silver Spring, MD; Boulder, CO; Seattle, WA; Miami, FL; and at various universities throughout the U.S. Information and services support national and international customers. More information about climate forcing research activities can be found at the following URLs: [http://www.climate.noaa.gov/index.jsp?pg=../cp\\_cf/description.html](http://www.climate.noaa.gov/index.jsp?pg=../cp_cf/description.html); <http://www.esrl.noaa.gov>; <http://www.esrl.noaa.gov/csd/>; <http://www.esrl.noaa.gov/gmd/about/climate.html>; <http://www.gfdl.noaa.gov/>; <http://www.pmel.noaa.gov>; <http://www.aoml.noaa.gov>.

The program also engages in NOAA crosscutting priorities via integration of global environmental observation and data management, ensuring sound state-of-the-art research, and exercising international leadership.

#### **2. PROGRAM REQUIREMENTS**

## A. Requirement Drivers

### Legislation

1. Global Change Research Act of 1990, 15 U.S.C. § 2921 *et seq.*: The Act makes reference to findings that include the observation of human activities that may lead to global changes and may adversely affect society. These include global warming and stratospheric ozone depletion. The Climate Forcing Program carries out research and assesses information in these areas.
2. Clean Air Act 1990 Title IV and Title VI, 42 U.S.C. § 7401 *et seq.*: This amendment to the Clean Air Act mandates that “the Administrators of the National Aeronautics and Space Administration and the National Oceanic and Atmospheric Administration shall monitor, and not less often than every 3 years following November 15, 1990, submit a report to Congress on the current average tropospheric concentration of chlorine and bromine and on the level of stratospheric ozone depletion.”
3. Global Climate Protection Act of 1990, 7 U.S.C. § 6701 *et seq.*: Requires research in climate change needed to protect the environment. The Climate Forcing Program produces results used for the decision support for protecting the environment.
4. Oceans Act 2000 (PL 106-256), leading to the Congressionally required report of the US Commission on Ocean Policy and the Executive response, the US Ocean Action Plan of 2005. Requires federal agencies to participate in building a Global Earth Observation Network, including integrated oceans observation. The US is implementing this through Integrated Ocean Observation System (IOOS), the Integrated Earth Observation System (IEOS), and participation in GEOSS. The Climate Forcing Program data and efforts are required to meet this goal.

### Interagency or International Agreements

5. *Climate Change Science Program (CCSP)*: CCSP integrates the Global Change Research Program and the *Climate Change Research Initiative*. This program requires the Federal Agencies to carry out research to quantify climate forcing by various agents, reduce the uncertainties in their evaluated forcings, produce timely prediction as well as generate synthesis and assessment reports (SARs) on various aspects of climate change. Data and efforts from NOAA’s Climate Forcing Program support or contribute to all of these requirements.
6. *U. N. Framework Convention on Climate Change (UNFCCC)*, that requires better quantification of the agents that force climate change by contributing research results and providing expertise to the assessments.
7. *Montreal Protocol on Substances that Deplete the Ozone Layer (and subsequent amendments)*, requires an assessment every four years of the state of the ozone layer, its recovery, and the amounts and origins of ozone depleting substances that drive the ozone layer changes. The influence of climate change on the future of the ozone layer and the consequences of ozone layer changes to the climate also need to be addressed through research and assessments.

8. *Global Earth Observation System of Systems. Third Earth Observation Summit held in Brussels on 16 February 2005, endorsing the Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan, describing the fundamental elements of an Earth Observation System and its principal expected benefits to a broad range of user communities.*

## **B. Mission Requirements**

1. Improve quantification of the forces bringing about changes in the Earth's climate and related systems; provide near-term and mid-term decision support information and assessments. (Drivers No. 1,3,4, 5, 6, 7, and 8)
2. Monitor the ozone layer and ozone depleting gases; understand changes; assess the consequences of changes. (Drivers No. 1, 2, 3, 5, 6, and 7)

## **3. LINKS TO THE NOAA STRATEGIC PLAN**

- A. **Goal outcomes:** Climate Forcing supports the Climate Goal outcome, *"A predictive understanding of the global climate system on time scales of weeks to decades with quantified uncertainties sufficient for making informed and reasoned decisions."*
- B. **Goal Performance Objectives:** Climate Forcing supports the Climate Goal performance objective, *"Reduce uncertainty in climate projections through timely information on the forcing and feedbacks contributing to changes in the Earth's climate."* Secondary objectives supported include *"Describe and understand the state of the climate system through integrated observations, analysis, and data stewardship"* and *"Improve climate predictive capability from weeks to decades, with an increased range of applicability for management and policy decisions"* and *"Increase number and use of climate products and services to enhance public and private sector decision making"*.
- C. **Goal Strategies:** Climate Forcing supports the following Climate Goal Strategies:
  - Improve the quality and quantity of climate observations, analyses, interpretation, and archiving by maintaining a consistent climate record and by improving our ability to determine why changes are taking place.
  - Improve the quantification and understanding of the forces bringing about climate change by examining relevant human-induced increases in atmospheric constituents.
  - Develop and contribute to routine state-of-the-science assessments of the climate system for informed decision-making.
  - Work with customers in order to deliver climate services and information products involved in health, safety, environmental, economic, and community planning that increase the effective application of this information.
  - Advance sub-seasonal to inter-annual climate predictions and climate change projections by improving analysis of the climate system, using ensembles of multiple, high-end climate and earth models.

#### 4. PROGRAM OUTCOMES

Climate Forcing has the following long-term outcomes:

- Improved understanding of atmospheric carbon dioxide trends for policy support and quantified carbon emission and uptake processes to form the needed input to climate-model improvements.
- New information on the climate roles of the radiatively important fine-particle aerosols, with an emphasis on aerosol-cloud interaction (the most uncertain of the climate forcing agents), and non-carbon dioxide greenhouse gases to provide decision support associated with options for potential near-term changes in radiative forcing of climate change.
- Verification of the recovery of the ozone layer and the decline of ozone-depleting chemicals in the atmosphere, thereby facilitating compliance with the Montreal Protocol and its safeguarding the Earth's ultraviolet shield.

#### 5. PROGRAM ROLES AND RESPONSIBILITIES

This program is established and managed with the procedures outlined in the NOAA Business Operations Manual (BOM). Responsibilities of the Program Manager are described in the BOM. Responsibilities of other major participants are summarized below:

##### A. Participating line office, staff office, and council responsibilities

1. OAR is responsible for conducting research through its Laboratories and Cooperative Institutes, as well as the Climate Program Office. .
2. NESDIS ORA is responsible for developing algorithms to retrieve carbon gas data from infrared satellite data and for satellite-based ozone-layer and aerosol-radiation monitoring.
3. The Aircraft Operations Center provides the fully outfitted WP-3, G-IV, and Twin Otter aircraft platforms, certain key meteorological and navigation data instrumentation, aircrew, and Aviation Project Management for the Climate Forcing Program that produces some of the data required for this performance measure. Specialized air chemistry instruments are provided by NOAA and PIs supported via extramural grants.
4. The NOAA Office of General Counsel (GC) is responsible for providing legal services necessary to enable the program to discharge its duties.
5. The NOAA Ocean Council (NOC) is established as the principal advisory body to the Administrator and coordination body for the agency's ocean activities and interests, including open ocean, near shore, coastal, estuarine and Great Lakes activities. The NOC is also authorized to develop a strategy and serve as the agency focal point for responding to and implementing the recommendations of

the President's Ocean Action Plan.

6. NOAA Weather and Water Goal: Climate Forcing participates with the following Programs: a) the Air Quality Program— joint studies on radiation balance and air-quality-health; b) Environmental Modeling— provides atmospheric composition data for impact scenarios; c) Science and Technology Infusion Program—joint effort in developing new measurement technologies for multiple observing platform use (e.g. UAV development).
7. Other Climate Goal Programs—The Climate Observations and Analysis Program includes support for the Baseline Surface Radiation Network, whose data are important for studies of climate forcing and aerosol-cloud interactions. This Program also supports ocean observations needed for evaluating air-sea exchange of carbon dioxide and other climatically important gases. The Climate Predictions and Projections Program requires information from the Climate Forcing Program to develop their input data for climate-change scenarios and model calculations.

#### **B. External Agency/Organization Partnerships:**

1. International partners—International Global Atmospheric Chemistry Program (IGAC) brings international research on the chemistry of the global troposphere and impact on the radiation balance. Stratospheric Processes and their Role in Climate (SPARC) Project of World Climate Research Program (WCRP) brings international research on stratospheric ozone changes and impact on climate. Several countries conduct cooperative research at NOAA Baseline Observatories, which are included, along with the comprehensive network for carbon dioxide and other gases, in the WMO Global Atmospheric Watch program and which support GCOS and GEOSS.
2. Climate Change Science Program—NASA and DOE, partners on the CCSP Products 2.2 – 2.4. NASA brings satellite technological input and DOE brings energy-related information.
3. Academia—the Program awards extramural research grants to study atmospheric composition and the global carbon cycle, to form complementary intramural-extramural research partnerships.

#### **6. END USERS OR BENEFICIARIES OF PROGRAM**

- Academia— Program awards extramural research grants to study climate forcing and also provides complementary partnerships with NOAA researchers and collaborative use of NOAA ships and aircraft; Collaborative research with NOAA Cooperative Institutes. Benefits to Academia: Data, scientific knowledge, resources to carry out research, and educational material/resources.
- Industry—Information about “ozone friendliness and climate friendliness of

potential new products prior to decisions and expenses associated with production. Contracts for research-related industry services, such as aircraft, chemicals, field equipment, and facility leasing. Benefits to Industry: Key information for their decision, receipt of money for the business.

- International, Federal, state, and local government agencies— Science-based information on gases and aerosols that is useful for decision-support needed to characterize options for altering radiative forcing, in both the near term (short-lived species like aerosols) and the longer term (carbon dioxide) in effective and efficient ways. Benefits to government agencies: Key decision support information and scientific know-how.
- Other NOAA Goals & Programs – Climate forcing data are needed for all climate related programs to be able to collectively provide a predictive understanding of the global climate system on time scales of weeks to decades. Data and cooperative operations are on-going with the W&W Air Quality program the Climate Observation and Analysis Program, and the W&W Science and Technology Infusion Program.